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AGASSIZ'S ESSAY ON CLASSIFICATION FIFTY YEARS AFTER¹

By EUGENE R. CORSON, M.D.

SAVANNAH, GA.

IT is well occasionally to go back to the old books. A different style, a use of words which have changed their meaning, a different atmosphere, in a way, carry you back at once, and you find yourself in new touch with the subject, but with the many advantages which the newer knowledge and the larger horizon have brought to bear. The original power is there still, as attracting, as compelling as ever: that can never change or fade, no matter what the mere information conveyed may be. But the real searcher will always find the information. The world seems ever ready to forget all but sharp and bare outlines, yet it is often the apparently minor details, slightly noticed at the time and quickly forgotten, which are the real treasure trove. I have found this to be the case in medicine even, where the changes and the new ideas are running ahead pell-mell.

Nearly fifty years ago when a student of zoology and comparative anatomy, I read Agassiz's "Essay on Classification." I can remember the pleasure it gave me, in spite of the fact that the entire scientific world was under the spell of Darwin, Huxley, Tyndall and Spencer, in England, and Haeckel in Germany. To me the book was a great book, no matter what ideas the author entertained of the Creation.

Evolution was the watchword; matter and force, *Kraft und Stoff*, seemed quite wholly to satisfy the scientific mind, even with its ignorance of what matter and force really were. Tyndall gave expression to the prevailing thought at the time in his Belfast address before the British Association. In a sentence long remembered, he declared:

By a necessity engendered and justified by science, I cross the boundary of the experimental evidence, and discern in that Matter, which we

¹ "An Essay on Classification." By Louis Agassiz, London, 1859. As stated in the preface, dated December 2, 1858, this essay first appeared as an introduction to a much larger work entitled, "Contributions to the Natural History of the United States." Three volumes, quarto. Two volumes had already appeared and the third volume was in the press.

in our ignorance of its latent powers, and notwithstanding our professed reverence for its Creator, have hitherto covered with Opprobrium, the promise and potency of all terrestrial Life.

Examined in the light of to-day the words seem to have lost much of their force and meaning: the sentence sounds grandiloquent and has lost its sting. Remember at the time it caused a great cry of indignation from both England and America, veritable hornet's nests of criticism. Its materialism seems very mild now. As a matter of fact there can be no terrestrial life without the promise and potency of matter, whatever way you look at it. The uncalled-for assumption that the world covered matter with opprobrium still further weakens it. The world was quite well satisfied with matter, too well satisfied, perhaps; it was a glorious thing, with a glory of its own, only, as many great souls thought, there was a greater glory back of it. I really believe Tyndall thought so too, only he was just fooling himself! Certainly his materialism could not be compared with the lifeless and soulless "monism" of the German.

Agassiz's students and admirers, while speaking in glowing terms of the great naturalist, his learning and scholarship, his enthusiasm, his wonderful knowledge of animal life, the intensity of his devotion to his work, yet deplored his refusal to accept the Darwinian theory as then set forth, an evolution of organic forms from the lowest to the highest, under the influence of the physical conditions as we saw them.

Darwin's "Origin of Species" appeared in 1859, an epochal work truly when compared with the previous developments in the natural sciences. It seemed to cut the Gordian knot of the mysteries of Creation. It brought to its support a great host of enthusiastic workers, ever ready to support it and find new proofs of its truth. To the German mind it was both appealing and compelling. It was ranked with Newton's law; it was accepted as explaining the entire scheme of life; the mystery of life itself seemed to disappear under the magic of the new conception.

At the time I read Haeckel's "Die Natürliche Schöpfungsgeschichte," and without a question my young mind accepted it. The captivating descriptions of the forms of life and their development carried with them an acceptance of the general reasoning and deductions. The German world of thought and science had fascinated and captivated the rest of the world. Students in every branch of learning were flocking to the German universities. It had become the medical center for all aspiring to the higher medicine; that the German mind was not a creative or even an inventive one, mattered not; that

through its genius for details and acquisition it had accomplished marvels in the physical sciences, but at the expense of the interior divinity, mattered not.

The beauty and wonder of Darwin's works were the careful and minute descriptions and comparisons, and the wealth of illustrations which he brought to bear in support of his thesis, with the theories and deductions much in the background. These he left largely to his followers. If he wanted a controversialist what better one could he find than Huxley. If he wanted the development of the theory on a larger scale, there was Spencer to spread the glad tidings world wide. Certainly he found in Ernst Haeckel the most enthusiastic and compelling follower and advocate who outheroed Herod in the physical aspects of the question. His trumpet blew a reveille then, a trumpet, which to my ears, as I read of his death in the last few days, seemed to be sounding taps. His earlier works and investigations of the lower and lowest forms of life are indeed all-embracing, but his philosophical writings are a hopeless logomachy, leading nowhere, a long trail into the bad lands, with no way out of the desert. There is a monism which is the basis of the Eastern philosophy and which has even found its way into the "*De Imitatione Christi*,"² all-embracing, the fullest expression of Spinoza's immanent God. Haeckel, in his aversion to any Deity, had taken a very small bit of it and called it "monism." The Eastern monist readily accepts the essential unity of the organic and so-called inorganic worlds, but in a vastly different sense from the German's idea. To the former it is all the one manifestation of the universal and divine mind, to the latter his "monism" was but the apotheosis of matter itself, as he saw it and worked in it all his life.

Steeped as he was in his own materialism, he could see no good faith nor sense in those who differed from him and looked beyond. In his "*History of Creation*" he took occasion to refer to Agassiz's attitude as insincere.

And now as I re-read this essay, I find that my whole mental attitude has changed. Darwin, Huxley and Haeckel fade out in a way and I see a great naturalist, certainly as well equipped as his opponents, as profound, as keen an observer—and whose voluminous works bear witness to his master mind—who has reached conclusions totally different. It is when it comes to the real vital question facing us that these minds differ. Go into the alcove in a great library and take down the works of Agassiz, his "*Fossil Fishes*," his "*Contributions to*

² Lib. 1, Cap. 3.

the Natural History of the United States," and others too many to mention here, and we know that such a life's work shows not one day wasted.

Haeckel had the advantage of a much longer life, yet he can show no greater industry, nor more accomplished. Haeckel is eager to give the world his philosophy, wretched as it is, offering nothing, not even husks for the swine to eat. Agassiz has no such desire, nor, as he tells us, has he time to be a philosopher outside his special field. His love of nature and of the Divine mind which *he* saw in nature filled his life completely as a naturalist.

This Essay on Classification may well have been placed at the head of the Bridgewater Treatises, but Agassiz could not be limited simply by the adaptation of means to ends, upon which these treatises were based; or the argument derived from the connection of organs and functions, for beyond certain limits it is not even true. A rudimentary and useless organ remains "not for the performance of a function, but with reference to plan." Notice the use of the word "plan" instead of "type," something pre-arranged, and yet a type, too. "So careful of the type she seems." The thought shows a great advance in the knowledge of animal forms over the old knowledge as expressed in the Bridgewater Treatises. While Agassiz sees in the rudimentary and functionless organ a proof of the separate creation of the type, and its careful preservation, Darwin sees an argument for his "descent with modification," and his "principle of successive slight variation."

Admirable as Sir Charles Bell's "Treatise on the Hand" was, both zoology and comparative anatomy had grown since his day, and a greater naturalist had a greater knowledge and a wider horizon before him. This advance was due to the developments in embryology, comparative anatomy and the microscope, and the many new forms of life described by the many workers in the field.

With the purely technical portions of the "Essay" I shall not deal; to the public generally Agassiz's spiritual attitude, his own philosophy of life, and what nature meant to him, is of greater interest, and of greater importance. In section 32 there is a re-capitulation of the entire first chapter, a chapter, by the way, which takes up more than half the book. He gives us here in a clear and emphatic way the reasons for his views, the features of nature as he saw them which compelled him to take the stand he took against a tidal wave of thought which had submerged all branches of science. There were few opposing voices in the universities: while the opposition came

largely from the religious world, there were many who saw no antagonism with religion.

For Agassiz, recognized as a great naturalist, a Harvard professor, a leader in his own field, this opposition showed a courage and an independence which only a great mind could command. In the recapitulation of his argument he gives us thirty-one features of the animal world as he saw it. He could see but one great system with the simultaneous existence of the most diversified types under identical circumstances, and with the repetition of similar types under the most diversified conditions. And there is ever before him this great unity of plan in otherwise highly diversified types, these types showing correspondences or special homologies in details of structure to the most minute peculiarities in animals otherwise entirely disconnected; and again degrees and kinds of relationships which can have no genealogical connection. From the standpoint of geology he sees the simultaneous existence in the earliest periods of representatives of all the great types, with gradations based upon complications of structure in animals built upon the same plan. Then there is the distribution of some types over the most extensive surface of the globe with others in limited areas; and again, combinations of these types into provinces of unequal extent, and again, identity of structure in animals otherwise entirely different, yet living within the same geographical areas. He sees wonderful series of special structures in animals widely scattered. He sees relations between the size of animals and their structure and form, and the independence in their size of the mediums in which they live. He dwells at length upon the permanence of specified peculiarities under every variety of external influences during each geological period, as well as at the present age, while at the same time, there is a definite relation of animals to the surrounding world and between individuals of the same species. He shows us that, while animals undergo apparently great changes during their growth, there is always a definite limitation of the range of changes. He sees design in the unequal limitation in the average duration of the lives of individuals of different species, and the return to a definite norm of animals which multiply in various ways.

Agassiz as the geologist was strongly convinced that the records all favored design and mind in the conception of the Creation. He emphasizes the order of succession of the different types of animals and plants characteristic of the different geological epochs, and the localization of some types upon some points of the globe during successive geological periods, as well

as the limitation of closely allied species to different geological periods; and so finally he traces a parallelism between the order of succession of animals and plants in geological times, and the gradation among their living representatives; and again, a parallelism between the order of succession of animals in geological times and the changes their living representatives undergo in their embryological growth; and again, finally, a parallelism between the gradation among animals and the changes they undergo during their growth. He even traces the combination in many extinct types of characters which in later ages appeared disconnected in different types, and the relations between these different series and the geographical distribution.

And finally he sees in the mutual dependence of animals and plants for their maintenance, and the dependence of some animals upon others or upon plants, a definite proof of design and of the divine mind.

All these features he described and elaborated in the preceding corresponding sections dwelling upon the modes of mind which they suggest and characterize—creative, purposeful, prophetic, consecutive, and sustained mind, in conformity with a plan laid out before. To him the creative mind is “independent of the influence of a material world.” In mind he sees the mind of a Creator and a God of Love.³

And again he sums it up in these words:

All organized beings exhibit in themselves all those categories of structure and of existence upon which a natural system may be founded, in such a manner that, in tracing it, the human mind is only translating into human language the Divine thoughts expressed in nature in living realities.

Agassiz did not accept the Biblical story of creation, nor that sexual relations determine species. He writes:

When first created, animals of the same species paired because they were made the one for the other; they did not take one another in order to build up their species, which had full existence before the first individual produced by sexual connection was born (page 253).

And again:

For my part, I can not conceive how moral philosophers, who urge the unity of Man as one of the fundamental principles of their religion, can at the same time justify the necessity which it involves of a sexual intercourse between the nearest blood relatives of that assumed first and unique

³ In this contrast of views it should ever be borne in mind that the unbiased reader can not find in the “Origin of Species” any real irreligion or denial of a Creator. The difference lay wholly in creative methods or views of the Godhead.

human family, when such a connection is revolting even to the Savage (page 254).

On the contrary, Agassiz contended that the evidence shows more and more strongly that animals originated in large numbers in disconnected geographical areas. Certainly the assumption of the first appearance of many scattered species involves no greater difficulties than that of the first animals appearing in pairs.

Agassiz constantly contends that what really exists are individuals, not species, a very subtle distinction which is in complete harmony with his conception of the whole animal creation. The study of the individual is the very keynote of nature study. The further we get from the individual, the nearer we come to the abstract. Those who contend that the individual is nothing and the mass everything, forget that zero multiplied by one million equals zero.

All students of zoology should read this essay for its clear and concise descriptions of the natural divisions among animals, namely, species, genera, families, orders, classes and types.

The description and analyses of the development of zoology, and the various systems of classifications, are characterized by a judicious calmness, and a considerate and even generous treatment of views which he could not accept.

Cuvier, who first brought to notice the four great types, and whose vast researches in the entire domain of zoology and paleontology placed these sciences on a permanent foundation, he regarded as the master mind of all the naturalists; he constantly refers to his indebtedness to him; he writes feelingly of his debt to Ignatius Döllinger, in whose home in Munich he spent four years of study; he regarded him as the founder of the modern science of embryology, and whom Pander and K. E. von Baer also acknowledged as their master; from him Agassiz learned the value and the possibilities of embryology, and were he to see to-day the marvelous advances of this science, I doubt if they would exceed his own prophetic vision.

The opponents of Agassiz, however bitter their criticism, could not deny his own equipment for his work either by education or natural ability; his works speak for themselves, and no matter what his individual views and theories may have been, there are the volumes, a storehouse of faithful observations, descriptive, comparative, comprehensive, and illustrated by drawings which have never been excelled, an inspiration for future workers for many, many years to come. There is this resemblance between Agassiz and Darwin, that they were both

absorbed throughout their lives in the study of animal forms and animal life, and that they had little time for theories and philosophies. I doubt if Darwin ever dreamed of the extent to which his followers as well as his critics would go.

Of the many phases of this evolution, of the many conceptions entertained, be it in the religious world, or in the universities, or by the man in the street, it was an evolution on a physical plane wholly, under the influences of the elements, of natural selection, of sexual selection, of a struggle for survival, of a survival of the fittest. To some the most devout, it was not inconsistent with orthodox religion; to many rationalists it was consistent with the highest Theism, witness the fine thinking of John Fiske; to the scientific world in general, and irrespective of any religious aspect, the theory as it stood was a foundation for all future research, a key to unlock many present and future secrets. Indeed its real opponents did not base their opposition on the ground of atheism, but because they thought evolution, as then conceived, to be in complete conflict with the universe as they saw it.

It was natural indeed that Darwin should find a complete acceptance in Germany, that Darwinismus should become a school of philosophy, elaborated and reelaborated with nothing left but *Kraft und Stoff*. And the world at large, fascinated by the marvelous intellectual activity of Germany, its amazing industry in research and the most minute investigation, aided by the most perfectly constructed instruments of observation and precision, should turn towards this great Mecca of science with a beating heart and with all confidence. For those who sought these perfected sciences it was the place to go. But it took the bloodiest war in history to show the world that marvels in the physical sciences, obtained at the expense of the interior divinity, must lead to ruin. We see it in the nation as a whole; we see it even more strikingly in the attitude towards the war of the most prominent scientific men—and even among the clergy—an attitude favoring a policy as cruel, as relentless, as world-destructive, as that of the arrogant and brutalized military class in power. Haeckel in particular showed this spirit; he signed a circular in 1916 demanding the retirement of von Bethmann-Holweg, arraigning him for his attitude of conciliation with England at the beginning of the war, his acceptance of Belgian neutrality, and his opposition to unrestricted submarine warfare. Such an attitude seems well in keeping with his philosophy of life, which saw no other creation but a casual, efficient, inevitable, correlation of cells, starting from the one

cell, whose psychic properties were the beginning of the psychism of man. And after man, what? Nothing, not even darkness visible. Surely this was evolution run riot; it was the old story of giving a beggar a horse to ride to the devil.

Now the greatest wonder of it all is that this evolution of the Western world is but a distorted echo or image of a higher evolution, taught by the East thousands of years ago, an evolution on a spiritual plane which we were to see only in a broken and partly disjointed form on our own plane of matter. But the East which is nothing if it is not logical and philosophical, and which must carry its logic and philosophy even to the Antipodes and to the ends of the worlds, taught an evolution and an involution; that what was evolved must eventually be involved; that the effect must go back to the cause; that cause and effect are really one; that every organic form as we see it has its spiritual prototype, a sort of spiritual blue-print, which must be copied to the minutest of the minutest detail. Though from a different starting point and from a different standpoint, it is the same as the Agassiz idea. This is surely better than the idea of life as a casual concourse of atoms; that out of a mass of vitalized sand and mortar a great living temple can be built up without any prototype or blue-print.

And this higher evolution seems to be in complete accord with the developments in molecular physics, a science which has become a true fairy tale, built up by the imagination of the higher mathematics, and which only the real mathematician may read and enjoy. It teaches an evolution of the elements, but it is on the etheric plane. The atom has become the atom of negative electricity; matter as we see it is a manufactured article, made by some one, and the only One, and made out of the invisible, into which it must eventually go back; that from hydrogen to gold is only many steps; that in the chemical reaction we see only the last step, and that it must take the inner eye to see the first; and that this is not only an idle dream, modern researches into electricity and radiant matter show.

I can not conceive of the universe except in terms of evolution and the figure of the circle. Evolution is everywhere: but it makes a great difference how we view this evolution and the forces or powers at work, whether from an earthly standpoint or from a little back of this earth as we see it. I can conceive of a higher evolution where all the steps or links are perfect, of which we can get but an imperfect expression: and I can easily imagine the two great minds of Agassiz and Darwin brought into accord on a middle ground by this higher evolution.

This evolution Agassiz surely could have accepted. Did he know Emerson well? Emerson could have taught him, Emerson to whom the *Song Celestial* was an open book.

Tyndall, in speaking of Agassiz's opposition to the theory of evolution as then set forth, mentions his visit to Cambridge, and his meeting Agassiz at a dinner party in Brookline, and Agassiz remarking in a sad way:

I confess that I was not prepared to see this theory received as it has been by the best intellects of our time; its success is greater than I could have thought possible.

But Agassiz stood as adamant. What Agassiz fought, I repeat, was an evolution on our physical plane.

As we look back these fifty years, surely the most wonderful changes have taken place. From Tyndall's day our whole conception of matter has been changed. Then it was indestructible: now we see the same matter resolving into its original invisible substance—the real substance. Then the elements were distinct and absolutely defined: now we know that the alchemists' dream of the transmutation of metals was not entirely an idle dream, however futile their efforts to bring it true.

I believe I am well within the truth when I state that the prevailing ideas on evolution as then taught have also undergone a change: that we are seeing, though perhaps dimly, the possibilities of an evolution just back of matter and life as we see it: that the ether, and spirit in whatever way we may try to conceive it, are the real substance, uninfluenced by cold and heat, and pressure, and all other physical conditions which we see affecting the matter of the laboratory and of the ground we walk upon; and finally, that the subtle changes of organic evolution must also be back of this physical plane, the form and quality of life appearing at that time and place best suited for its functioning. I can not help feeling that Agassiz's heroic stand, even with a Scotch verdict, has been justified by the years which have passed by.

Whether his God was the extracosmic God of orthodox Christianity, or the immanent God of Spinoza, does not especially interest me: his real spiritual attitude he has fully shown.

If Haeckel was right and Agassiz wrong, perish the thought: rather let me live in a fool's paradise along with such a soul as that of Louis Agassiz.